CLAIMS

What is claimed is:

1. A method for inducing a spatially modulated refractive index pattern in an at least partially light transmissive or absorbing material, comprising the steps of:
providing the at least partially light transmissive or absorbing material;
disposing a mask to be used as an interferometer, adjacent to the partially light transmissive or absorbing material such that light incident upon the mask is transmitted directly into said material; and,
irradiating surface of the mask with electromagnetic radiation having a predetermined wavelength range and having a pulse duration of less than or equal to 500 picoseconds, wherein the mask is disposed to permit a portion of the electromagnetic radiation to interact with the mask and be incident on the at least partially light transmissive or absorbing material, the interaction of the electromagnetic radiation with the mask for producing a spatial intensity modulation pattern within the at least partially light transmissive or absorbing material, the electromagnetic radiation incident on the at least partially light transmissive or absorbing material being sufficiently intense to cause a change in an index of refraction of the at least partially light transmissive or absorbing material, wherein electromagnetic radiation interacting with the surface of the mask has a sufficiently low intensity to not significantly alter produced spatial intensity modulation properties of the mask.

2. A method of inducing a spatially modulated refractive index pattern as defined in claim 1 wherein the at least partially light transmissive or absorbing material is a cladding of an optical waveguide and wherein the step of the mask is disposed to permit a portion of the electromagnetic radiation to interact with the mask and be incident on the cladding, the interaction of the electromagnetic radiation with the mask for producing a spatial intensity modulation pattern within the cladding, the electromagnetic radiation incident on the

cladding being sufficiently intense to cause a change in an index of refraction of the cladding, the electromagnetic radiation interacting with the surface of the mask having a sufficiently low intensity to not significantly alter produced spatial intensity modulation properties of the mask.

3. A method of providing a spatially modulated refractive index pattern in at least a partially transmissive or absorbing material, as defined in claim 1, wherein the step of disposing a mask to be used as an interferometer includes the steps of disposing and orienting the mask adjacent to the at least partially transmissive material at a distance "d" such that group velocity walk-off results in pure 2-beam interference within the at least partially transmissive or absorbing material when irradiated with a pulse of light of less than or equal to 100 picoseconds, wherein the distance "d" is chosen such that the difference in times of arrival of the order pairs due to group velocity walk-off results in the pure 2-beam interference pattern of subbeams of said pulse of light that have passed through or reflected off of the mask.

4. An optical waveguide grating comprising:

a core having a refractive index n_1;

a cladding provided around an outer periphery of said core, said cladding having a refractive index n2 different than the refractive index n1 of said core, wherein the cladding is not substantially photosensitive to actinic radiation (UV); and,

a grating written in the cladding.

5. A method, as defined in claim 1 for inducing a spatially modulated refractive index pattern in an at least partially light transmissive or absorbing material wherein said material is an optical waveguide having a cladding and a core and wherein the modulated refractive index pattern is a blazed grating.

6. A method as defined in claim 2 wherein the spatially modulated refractive index pattern is a grating and wherein a grating is also written in a core of the optical waveguide.

7. A method as defined in claim 6 wherein the grating in the core and the grating in the cladding is contiguous and extends across a boundary between the cladding and the core along a cross-section of the waveguide.

8. An optical waveguide as defined in claim 7, wherein the grating extending through a cross section of the core and the cladding is substantially uniform, said grating for reflecting a component of light propagating through said core having a predetermined wavelength.

9. A method as defined in claim 1, wherein the at least partially light transmissive or absorbing material is an optical fiber and wherein the optical fiber comprises an external jacket layer and wherein in the step of providing electromagnetic radiation, a portion of the electromagnetic radiation propagates from the diffractive optical element through the external jacket layer.

10. A method as defined in claim 2 where the cladding comprises more than one cladding region.

11. A method according to claim 6 wherein the grating structure in the core and cladding is larger than the cross-section of the fundamental guided mode where the coupling coefficient between core and cladding modes is near zero

12. A method according to claim 6 where the optical waveguide is an optical fiber, wherein the grating structure in the core and cladding is larger than the cross-section of the LP_{01} guided mode where the coupling coefficient $\kappa_{01,\mu\nu}$ between core and cladding modes is near zero.

13. A method according to claim 2 where said cladding is not photosensitive to actinic UV radiation.

14. An optical waveguide according to claim 1 where said at least partially transmissive or absorbing material is an optical waveguide and wherein the modulated refractive index pattern is in a fusion region of a fused biconic tapered coupler.

15. A method according to claim 1 wherein the at least partially light transmissive or absorbing material is a tapered optical fiber.

16. A method according to claim 3, wherein the at least partially transmissive or absorbing material is an optical waveguide having a core and a cladding.

17. A method according to claim 1, comprising the step of providing a laser source and a focusing element, the laser source for providing the electromagnetic radiation, wherein the focusing element focuses electromagnetic radiation provided by the laser source to a region near a surface of the at least partially transmissive or absorbing material such that said electromagnetic radiation does not significantly alter the spatial intensity modulation properties of the mask.

18. A method according to claim 1, comprising the step of providing a laser source and a focusing element, the laser source for providing the electromagnetic radiation, wherein the focusing element is optically disposed between the laser source and the mask, the focusing element for focusing electromagnetic radiation provided by the laser source to a region near a surface of the at least partially transmissive or absorbing material such that said electromagnetic radiation does not significantly alter the spatial intensity modulation properties of the mask.

19. A method as defined in claim 1 wherein during the step of providing electromagnetic radiation, the at least partially transmissive or absorbing material and the beam are relatively moved so as to extend the grating.

20. A method for inducing a spatially modulated refractive index pattern in at least a partially transmissive material or absorbing, comprising the steps of:

providing the at least partially transmissive or absorbing material;

disposing and orienting a mask adjacent to the at least partially transmissive or absorbing material at a distance "d" such that group velocity walk-off results in at least 2-beam interference within the at least partially transmissive or absorbing material when irradiated with a pulse of light of less than or equal to 100 picoseconds, wherein the distance "d" is chosen such that the difference in times of arrival of the order pairs due to group velocity walk-off affects the number of interfering order pairs to produce an at least 2-beam interference pattern of subbeams of said pulse of light that have passed through or reflected off of the mask;

irradiating the mask with pulsed light having a duration of less than 100 ps to generate the index modulated pattern in the at least partially light transmissive or absorbing material.

21. An optical waveguide having a grating formed in the core and cladding of the waveguide, wherein the grating is substantially uniform and contiguous from the core and into the cladding made by the method of claim 20, and wherein the spatially modulated refractive index pattern defined in claim 20 forms the grating.

22. A waveguide as defined in claim 21, wherein the at least partially light transmissive or absorbing material is SMF-28 optical fiber.

23. A method as defined in claim 1 wherein the at least partially light transmissive or absorbing material is a crystal.

24. A method according to claim 1, wherein the at least partially light transmissive or absorbing material is a sapphire optical fiber, the sapphire optical fiber having an induced index change for providing a single-mode core, the single-mode core for propagating electromagnetic radiation at a design wavelength.

25. A method as in claim 1 where in the mask is a phase mask.

26. A method of inducing a spatially modulated refractive index pattern as defined in claim 1 wherein the at least partially light transmissive or absorbing material is a core of an optical waveguide and wherein the step of the mask is disposed to permit a portion of the electromagnetic radiation to interact with the mask and be incident on the core, the interaction of the electromagnetic radiation with the mask for producing a spatial intensity modulation pattern within the core, the electromagnetic radiation incident on the core being sufficiently intense to cause a change in an index of refraction of the core, the electromagnetic radiation interacting with the surface of the mask having a sufficiently low intensity to not significantly alter produced spatial intensity modulation properties of the mask.

27. An optical waveguide according to claim 26 where said core is not photosensitive to actinic UV radiation.